

The Cornell Botanical Expedition, after a trans-continental trip from Ithaca, New York, arrived in California over Mt. Shasta in September. The party consisted of nine persons traveling in three machines. Three thousand specimens were collected and almost as many species. Dr. K. M. Wiegand headed the expedition. A portion of the party under the guidance of Dr. W. L. Jepson made a trip to the great redwood groves of the South Fork Eel River, studying especially the stand on the Bull Creek flats where are the tallest of the Earth's trees.

Dr. Olof Arrhenius visited the University of California in August. During a discussion of the outlook for botany he said: "I am surprised at the little time you in American universities have for research. It is too bad that botany is not regarded in America as a practical science. I notice that public opinion has so much to do with what is given in the University. But what does public opinion know about the needs of the sciences of Physics, Chemistry and Botany? We have disadvantages at home—but public opinion does not control the universities. The universities should be independent—for scholarship and research."—W. L. J.

## REVISION OF THE CALIFORNIA SPECIES OF THE GENUS ARCTOSTAPHYLOS

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Hooker and Arnott in the *Botany of Beechey's Voyage* (1832) record only two manzanitas from California, the two being recorded as unnamed varieties of *Arctostaphylos tomentosa*. In the *Botany of California* (1876) Gray described eight species of *Arctostaphylos* exclusive of *Comarostaphylis*. In the *Synoptical Flora* (1878), Gray has for California eleven species and one variety. In the *North American Flora* (1914), under the generic name *Uva-ursi*, Abrams recognizes as Californian, twenty-two species but no varieties. In the treatment here presented twenty-three species and eight varieties are recognized, but certain species reduced in the *North American Flora* are retained as valid.

The segregation of Californian *Arctostaphylo* into recognizable and satisfactory units presents difficulties. Leaves, flowers and fruits are very uniform in the genus and largely without strongly marked or distinctive morphological characters. The various species as here evaluated differ most obviously in habit and in what may be termed vegetative characters—in stature, in pubescence or glandulosity or lack of these, and also in hue of foliage. These characteristics or adaptations on the whole seem to be specific and rather decisive, and the main types as one sees them in the field, particularly in the Sierra Nevada, usually represent recognizable units which are commonly very distinctive in appearance. The extensive formations of the white *Arctostaphylos viscida* give a

cast to the scenery which is very different from the tone of the green colonies of *Arctostaphylos patula*, whilst both, forming impenetrable thickets, have nothing habitally in common with the rough mat of *Arctostaphylos nevadensis* over which one may walk. Each of the various units in the Sierra Nevada, moreover, is restricted to a certain zone or topographic area, capable of being rather definitely defined in terms of climate and altitude, that is to say they are habital units fairly in harmony with the physical factors. In the Coast Ranges the segregation of *Arctostaphylos* units presents a more embarrassing complex, since changes in soil and climate are more local and more multiplied and involved.

The evaluation of the species in this paper rests upon a basis different from that hitherto employed in this genus. Important weight is given to the character of the pubescence on the peduncles and pedicels of the inflorescence and on the foliage, to the glandulosity or the lack of it, to the hue of the foliage, and to the nutlets. Altho commonly thought of as unstable or ecological the pubescence and its character give in this genus useful and often dependable differentiae, as well as the glandular character or its absence. While the definition of species on the basis of such minute characters is scarcely ever satisfactory the species in this case have, in a most interesting way, been stabilized by support derived from neglected but yet striking facts of their life history. In other words, the species as segregated by the characters above indicated, are further fortified by the facts of their biological reaction to fire and this character, it is to be emphasized, does not cut across the characters described above and used as initial differentiae, but parallels them closely. Certain species are killed completely by chaparral fires and depend exclusively upon seed for regeneration in their area. Other species crown-sprout after fire and develop in various ways heavy root crowns or broad tabular structures at the surface of the ground. In small groups of closely related species, groups so close that the component units have been defined only by critical reference to the minute characters of pubescence and glandulosity—the units of such groups will nevertheless show the strongest difference in their reaction to destructively high temperatures in a chaparral fire and display decisive cleavages which parallel the somewhat obscure structural differences.

1. *A. GLAUCA* Lindl. The characters of recognition for this species are its glaucous foliage, large viscid berries and globose stones, the last being a very striking mark. While the large solid smooth stones are very characteristic, small almost spindle-shaped stones acute at each end may sometimes be found on the same shrub with fruits containing large globose stones. Again an entire shrub may bear only the former type of stone. This state appears in some cases at least to be connected with under-nutrition.

*Arctostaphylos glauca* is common in Southern California and is not infrequent in the inner South Coast Ranges. It has sometimes

been reported from the North Coast Ranges, but thus far only on the basis of mistaken determination.

In the lower part of Mill Creek Cañon, San Bernardino Mts., I measured in 1913 an individual 22 feet high with its short trunk 1 foot 1 inch in diameter. In September, 1920, I measured the large individual which stands on the trail up the ridge backbone from Donner Cañon to Cold Spring below the saddle of Mt. Diablo. It is 18 feet high, 24 feet broad across the crown, the trunk 21 inches in diameter at 4 inches above the ground. This is a remarkable tree.

Locs.—Las Trampas Ridge, Contra Costa Co., *Jepson* 6853; Donner Cañon, Mt. Diablo, *Jepson* 7592 (this and the next two have glandular-pubescent pedicels); Cedar Mt., Mt. Hamilton Range, *Jepson* 6219; Peachey Cañon, San Luis Obispo Co., *Barber* a3; Santa Inez Mts. (acc. Abrams in N. Am. Fl. 29:101); Arroyo Seco, near Los Angeles, *Braunton* 790; San Antonio Cañon, Claremont, *C. F. Baker* 4013; Mill Creek, San Bernardino Mts., *Jepson* 5587 (pedicels viscid-glandular); Indian Cañon, Collins Valley, *Jepson* 8857; Warner Ranch, *Jepson* 8527; Cuyamaca Mts., *Palmer*; San Diego, *Mary F. Spencer*.

Var. *EREMICOLA* *Jepson* n. var. Leaves purple-veined; berry elliptic.—Piñon Well Mts., n. Colorado Desert, *Jepson* 6004.

Refs.—*ARCTOSTAPHYLOS GLAUCA* Lindl. Bot. Reg. sub. t. 1791 (1836), type from Cal., *Douglas*; *Jepson*, Fl. W. Mid. Cal. ed 2, 314 (1911). Var. *EREMICOLA* *Jepson*.

2. *A. VISCIDA* Parry. This species forms a broad band in the Sierra Nevada foothills from Shasta Co. to Tulare Co., but with a break in the band between the Stanislaus and Kings rivers, which is occupied by the closely allied *A. mariposa* Dudley. This interruption in the distribution can now only be stated broadly and its exact limits and the nature of it will eventually be more definitely defined. This species is however the most characteristic and widespread member of the genus in the Sierra foothills and is now reported from the inner North Coast Ranges. Its deep-red small berries are either viscid or not viscid in a given locality and indeed viscid and non-viscid berries may sometimes be found on a single shrub. It forms extensive exclusive or nearly exclusive colonies, the individuals of which are often densely massed.

Locs.—Sierra Nevada: North Fork Tule River (berry viscid), *Jepson* 4702, 4720; Middle Tule River, *Jepson* 4861 (berry viscid); Mokelumne Hill, *Blaisdell*; Shingle Sprs., *F. B. Herbert*; Rough and Ready, Nevada Co., *Jepson*; Oroville, comm. *A. E. Wieslander*; Cow Creek Mts., Shasta Co., *Baker & Nutting*. Coast Ranges: Oro Fino, Siskiyou Co., *Butler* 659, 693; Klamathon, Siskiyou Co., *Copeland* 3519 (berry not viscid); Dunsmuir, *Jepson*; Delta, *Jepson* 6178 (berry not viscid); Greasewood Hills, w. Tehama Co., *Jepson*; Red Mt., n. Mendocino Co., *Eastwood*; Lake Co., *K. Brandege* (berry viscid); Knoxville Ridge, *Jepson* 9047; Moore

Creek, Howell Mt. (berry viscid), *Jepson* 6826, 6840; Chiles Mill, Chiles Creek, *Jepson* 9067.

Ref.—ARCTOSTAPHYLOS VISCIDA Parry, Bull. Cal. Acad. 2:492 (1887), type loc. Ione, Amador Co., *Parry* (Mar. 9, 1887).

3. *A. MARIPOSA* Dudley is very closely related to *A. viscida*. It is distinguishable from that species by its glandular-hairy branchlets, peduncles and ovary but the differentiae are sometimes difficult to apply. Both are white-foliaged manzanitas of the same size and method of branching. *A. mariposa* may not be eventually sustainable as a species. Its inflorescence is, however, remarkably glandular—so glandular that it is noticeable that the flowers stick to the clothing of travelers passing through the chaparral.

Locs.—Columbia, *A. L. Grant* 627; Yankee Hill, *Jepson* 6450; Confidence, Tuolumne Co., *Jepson* 7695; Big Creek, Big Oak Flat road, *Jepson* 8341; Mariposa, *Congdon*; El Portal, *Jepson* 5671; Tehipite Valley, *Hall & Chandler* 491.

Var. *BIVISUM* *Jepson* n. var. Leaves dark green,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  in. long; branchlets, glandular-hairy and somewhat dusky; berries whitish with a somewhat transparent or lucent quality.—Yosemite Park: near Wawona, *Jepson* 5658; Hetch-Hetchy, *Jepson* 3452 (type).

Refs.—ARCTOSTAPHYLOS MARIPOSA Dudley; Eastw., Sierra Club Publ. 27:52 (1902), type loc. "Millwood and King's River Cañon," *Eastwood*.

4. *A. PATULA* Greene grows at higher altitudes than any of the preceding species. It inhabits the Yellow Pine belt in all the higher ranges of California and also spots the cañon tali with low dark green dots on a white granite ground. It is commonly the only species in its area or the only erect species. It is remarkable for its bright green glabrous leaves reminiscent of *A. stanfordiana*. Its berries are medium sized, glabrous, and usually though not always very hard when mature. The root develops into a globose or carrot-shaped structure which crown-sprouts after fire or mutilation. It does not form a broad root-crown structure like *A. glandulosa*. The branches are often weighted down by winter snow and these at their depressed bases often root by adventitious rootlets. Indeed after fire this species spreads in circles in this way.

*A. patula* has the widest range of any Californian species and is most abundant in individuals. It is remarkably uniform in habit and in technical characters throughout its range.

Locs.—Sierra Nevada: McCloud, *Jepson* 5743; Upper Fall River Valley, *Jepson* 5775; Susanville, *Jepson*; Johnstown, *L. S. Smith*; Taylorsville, Plumas Co., *Jepson* 8017; Plumas Co., *Platt*; Brush Creek, Butte Co., *Kate Conger*; Sierraville, *Jepson*; Mt. Tallac, *Jepson* 8132; American River, *Kennedy* 158; Bald Mt., near Sonora, *A. L. Grant* 667; Strawberry, Tuolumne Co., *A. L. Grant* 22; Glacier Pt., Yosemite, *Jepson* 5659; Patterson Mt., Fresno Co., *A. E. Wieslander*; Millwood, *Jepson* 2778; Wawona (towards



Mariposa Grove), *Jepson* 5645, 5653; Whitney Creek, *Jepson* 1100; Garfield Forest, South Fork Kaweah, *Jepson* 4664; Kern Lake, *Jepson*; Lloyd Mds., Kern River, *Jepson* 4891; Cottonwood Creek, Inyo Co., *Jepson*. North Coast Ranges: Shasta Retreat, *Butler* 640; Dunsmuir, *Jepson* 6163; Weed, *Butler* 657; Sisson, *Jepson* 5787; Edgewood, *Kisling*; Trinity Summit, *Jepson* 2062; South Yollo Bolly, *Jepson*; Mt. Hull, *Hall* 9567. Southern California: North Baldy, *Peirson* 143; divide betw. Bear Valley and Santa Ana Cañon, *Parish* 19288; Mill Creek, San Bernardino Mts., *Jepson* 5589; Mt. San Jacinto, *Hall* 2419. Glenbrook, Douglas Co., Nev., *C. F. Baker* 1001; Ash Cañon, Ormsby Co., Nev., *C. F. Baker* 979 (branchlets slightly canescent). Var. *INCARNATA* *Jepson* n. var. Corolla pink, its lobes erect.—Sacramento River Cañon (Dunsmuir, *Harriet P. Kelley*, type.)

Refs.—*ARCTOSTAPHYLOS PATULA* Greene, *Pitt.* 2:171 (1891), type spms. from central Sierra Nevada (Calaveras Co. to Fresno Co.); Merriam, *N. Am. Fauna*, 16:157 (1899). *A pungens* var. *platyphylla* Gray, *Syn. Fl.* 2:28 (1878), type from Cal.

5. *A. STANFORDIANA* Parry is related to *A. patula* Greene on the one hand and to *A. manzanita* Parry on the other. Its root-system is rather superficial like that of *A. manzanita*, and it does not form heavy or globose root-crowns as does *A. patula*. It is distinguishable from *A. manzanita* by its smaller size, more erect habit, glabrous leaves and usually glabrous rachis and by the remoter bractlets of the raceme. It favors the mountain summits and higher ridges of the central North Coast Ranges, and thus commonly grows at higher altitudes than *A. manzanita*, though not found beyond the horizontal range of that species. It is remarkable for its clean trim habit. The leaves are just alike on both sides. The small berries are very irregular in shape, as if without definite form, or typical only in deformation. A few individuals of it have recently been discovered on Mt. Diablo, about half-way up the south slope.

Locs.—Mt. Diablo, *Jepson* 9653; Moore Creek, Howell Mt., *Jepson* 6827; La Jota Plateau, Howell Mt., *Jepson*; Mt. St. Helena, *Jepson*; Scotts Valley, Lake Co., *Tracy* 1698; Mendocino Range, sw. of Ukiah, *Jepson* 7629; Bartlett Mt., *Eastwood*; Red Mt., n. Mendocino Co., *Eastwood*; Round Valley, *Westermann*; Red Rock, ne. of Round Valley, Mendocino Co., *Jepson*.

Refs.—*ARCTOSTAPHYLOS STANFORDIANA* Parry, *Bull. Cal. Acad.* 2:493 (1887), type loc. Napa Range near Calistoga, *Parry*; *Jepson*, *Fl. W. Mid. Cal.* 371 (1901), *Univ. Cal. Mag.* 2:102 (1896).

6. *A. ELEGANS* *Jepson*, though collected three decades since, is still known only by the original collection. It is not related to *A. manzanita* but is near *A. stanfordiana* in character of foliage and branchlets.

Ref.—*ARCTOSTAPHYLOS ELEGANS* *Jepson*, *Erythea* 1:15 (1893), type loc. obsidian slopes southerly from Mt. Konocti (Uncle Sam

Mt.), Lake Co., *Jepson*. The note in *Erythea*, 3:178, was an inadvertence.

7. *A. PUNGENS* H. B. K. This species is not uncommon on the plateau of Mexico at 7000 to 8000 feet. It ranges northward through Arizona into California, at constantly decreasing altitudes as it moves northward, though keeping to the tops of the mountains. With us it appears to be rather rare, but its range is in harmony with the geographic distribution of plants entering California from the southward.

It is to be pointed out that material from California referred to *A. pungens* is with difficulty differentiated from *A. manzanita*. *A. manzanita*, however, occupies a distinct geographical area; and it is retained as a species because it represents a different phase from *A. pungens* in our manzanita series.

The following specimens from California can be cited as examples: Onstatts Valley, San Jacinto Mts., *Hall*; Pecacho Peak, s. Benito Co., *Hall* 9947. The plants of Marin Co. (which grow along the high ridges of the Mt. Tamalpais region and which have been known as *A. montana* Eastw.) agree well in pubescence, leaves and other characters with the Southern California specimens just cited and I hold them to be conspecific. Some of them show well, tho not in the extreme form, the characteristically short and abrupt but very sharp point to the leaf apex (Rock Spr., *Jos. Saunders*; Mt. Tamalpais, *Jepson* 4761; Bill Williams trail, *Jepson* 9504); in other specimens this structure is less marked (Lagunitas, *Chestnut & Drew*; near Cypress Grove, Mt. Tamalpais, *Jepson* 6806), just as in some of the specimens from Mexico.

Fine examples of this Marin Co. form as it occurs on Mt. Tamalpais may be seen along Bill Williams trail between the Mountain Theater and West Peak. One individual is fairly typical and is noteworthy for its size and remarkable for its habit of growth. This individual is quite erect, 6½ feet high, and with an open crown recalling *A. manzanita*. After having attained its height maturity, it then, under some stimulus, threw out elongated lateral stems from the trunk base. These strong stems are very long, very densely branched in the top, and form or complete a low broad crown to the shrub, gently sloping to the ground from the center. The shrub as thus amplified is 24 feet in diameter and very thick and smooth, except in the center occupied by the original or first erect growth.

Although out of harmony with the general distribution in California, a specimen from Big Silver Creek, El Dorado Co. (*Kennedy* 228), is included here with some doubt.

Refs.—ARCTOSTAPHYLOS PUNGENS H. B. K. Nov. Gen. & Sp. 3: 278 (1819), type loc. mt. slopes near Mexico City. *A. montana* Eastw. Proc. Cal. Acad. ser. 3, Bot. 1:83 (1897), type loc. trail betw. Eldridge grade and Larsens, Mt. Tamalpais, *Eastwood*; l. c. 1:127 (1898).

8. *A. MANZANITA* Parry is the largest species of the genus, though the trunk of *A. glauca* may sometimes become as massive. In the Napa Range *A. manzanita* forms interesting pigmy forests 8 to 14 feet high on the lower western slopes of Howell Mt. Sometimes it is massed in closed stands, appearing as smooth as a meadow floor when seen from above. In more open situations the individuals become 13 to 22 feet high. In Lyons Valley on the westerly slope of Howell Mt. measurements of three especially large individuals were secured: *a.* Near Stingy Stile, Eden trail to Adam and Eve, height 15 ft.; trunk 4 ft. high before branching into 4 arms; trunk diameter at 3 ft. above ground, 1 ft. 2 in. *b.* Shoulder of hill to right of trail, 35 yards easterly from Stingy Stile, height 18 ft.; trunk 2 ft. high before branching into 5 arms; trunk diameter at 1½ ft. above ground, 1 ft. 2 in. *c.* On the little ridge to west of Lyons Valley, tree by path, height 22 ft.; trunk 1 ft. 8 in. before branching into 2 arms; smallest trunk diameter (at ground) 11¾ in.

*Arctostaphylos manzanita* is killed outright under chaparral fires. One sees the dead bodies of these arborescent shrubs, 8 to 15 feet high, standing like white skeletons in the fire-burns of chaparral areas, for they soon lose their red-brown bark and reveal the white sapwood beneath. While shallow-rooted, they are not as shallow-rooted as *A. stanfordiana*, the bodies of which are overthrown in the first winter storms. *A. manzanita* on the other hand may stand for some years, but finally the roots decay and a touch will send an individual crashing to the ground.

*Arctostaphylos manzanita*, therefore, reproduces exclusively by seed. It is an aggressive species. At the present time, in the centers of its greatest development, it is invading new areas or recovering old ones. Along the Napa Range and in Mendocino Co. considerable slopes on the lower hills were cleared thirty to forty years ago for cultivation or grazing. Within ten or fifteen years much of this land has been permitted to revert to primitive conditions. Seedlings of this species appear in large numbers in these neglected fields or old vineyards, as they do also on burns. Such seedlings represent a cumulative crop of seeds—perhaps ten to forty years—and indicate the long persistent vitality of the seeds.

Along the lower slopes bordering the valleys of central Mendocino Co., about Ukiah Valley, and particularly from Long Valley to Cummings, *Arctostaphylos manzanita* is abundant. It occurs mostly below the open stand of *Quercus kelloggii* and *Pinus ponderosa*, covering the bases of low hills which border the narrow valleys and colonizing the opens and flats. From Cummings one may follow it westward to the headwaters of the South Fork Eel River in western Mendocino Co. where it occurs near Piercey sta. In the inner Coast Range it is less frequent or rare, but is found on Mt. Diablo; summit of the Vaca Mts.; and near Jerusalem Valley, Wilbur Sprs., and Indian Valley—all in eastern Lake Co. In the Sierra Nevada foothills it occurs from Tehama Co. south to Tuo-

lumne Co. Definite stations in the Sierra Nevada are now for the first time indicated.

The binomial *Arctostaphylos manzanita* has been made to do duty over too wide a range; indeed it has been applied to other species in all parts of California. It is, however, one of the most definite of our manzanitas and is as yet known only from the foothills of the North Coast Ranges towards the interior and the Sierra foothills from Tuolumne Co. northward. It also occurs locally on Mt. Diablo.

Locs.—Coast Ranges: cañon at head of Sycamore Creek, Mt. Diablo, *Jepson* 9660, 9736; Gates Cañon, Vaca Mts., *Jepson* 2331; Howell Mt. foothills, *Jepson*; Mt. St. Helena, *Jepson* 7669; Jerusalem Valley, se. of Lower Lake, *Jepson*; Wilbur Sprs. and Indian Valley, ne. Lake Co., *Jepson*; Hough Sprs., *Jepson* 9005; Blue Lakes grade to Ukiah, *Jepson*; Elk Mt., n. Lake Co., *Tracy* 2352; Willow Creek, Trinity River, *Tracy* 3449; Asa Bean Ridge, ne. Mendocino Co., *Jepson*; Greasewood Hills, w. Tehama Co., *Jepson*. Sierra Nevada foothills, 500 to 3500 feet (in association with *Quercus douglasii*): Los Molinos, *Harriet P. Kelley*; Shingle Sprs., El Dorado Co., *F. B. Herbert*; Amador Co., *Hansen*; Gwin Mine, Calaveras Co., *Jepson* 1796; Copperopolis, *Davy* 1363; Columbia, *Jepson* 6397.

Var. *APICULATA* *Jepson* n. var. Berry with a short conical apiculation.—Head of Weldon Cañon, Vaca Mts., *Jepson* 7198 (type).

Refs.—*ARCTOSTAPHYLOS MANZANITA* *Parry*, Bull. Cal. Acad. 2:491 (1887), type loc. Napa Range near Calistoga, *Parry*; *Jepson*, Fl. W. Mid. Cal. 371 (1901).

9. **A. *pastillosa*** *Jepson* n. sp. In the higher foothills of the Sierra Nevada a manzanita occurs in a belt between that of *A. viscida* below and *A. patula* above. It is a vigorous shrub and has large berries which in shape and often in hue suggest the loaves of bread seen in bake-shops in Italy. It ranges from Placer Co. to Tulare Co. The formal diagnosis appears below.

Locs.—Cold Spr., North Fork Tule River, *Jepson* 4704; Strawberry, Tuolumne Co., *A. L. Grant* 888; Cold Spr., Tuolumne Co., *Jepson* 6456 (type); Bald Mt. near Sonora, *A. L. Grant* 666, 553; Yankee Hill near Columbia, *A. L. Grant* 598; Shingle Sprs., *F. B. Herbert*.

*A. MEUKKA* *Merriam*, Proc. Biol. Soc. Wash. 31:101 (1918), type loc. ridge between North Fork American and Bear Rivers above Colfax, *Merriam*. The life history of this species is too insufficiently described to be placed with certainty in this series as here arranged. The specific name, borrowed from the Miwok tribe, seems barbarous. Dr. Johnson once said, however, that no language is barbarous to the person to whom it is native. Dr. Merriam has cultivated Indian lore and tribal habits so long that *meukka* to him is probably as pleasing as the lucent phrases of the *Ars Poetica* to the ear of Horace.



10. *A. NEVADENSIS* Gray is a low species, analogous to *Ceanothus prostratus* Benth. in the Rhamnaceae, though not as completely prostrate, but growing like it on the floors of the open pine woods. Its main stems, prostrate and rooting, are  $\frac{1}{2}$  to 2 feet long and bear ascending or erect branchlets 3 to 4 inches high or up to 6 or 9 inches high. It occurs in the high North Coast Ranges and in the Sierra Nevada but is rare south of Mariposa Co.

Locs.—Sierra Nevada: Summit, Nevada Co., *Jepson*; Tahoe, *Katharine Chandler*; Mt. Tallac, *Jepson* 8136; Bierstadt Peak, *Davy* 3181; McClure Fork, Merced River, *Jepson* 3223; Glacier Pt., *Jepson* 5678; Bald Mt., Fresno Co., *Hall & Chandler* 414; Mt. Moses, *Purpus* 1369. North Coast Ranges: Hull Mt., *W. W. Mackie*; Soldiers Ridge, ne. Mendocino Co., *Jepson*; South Fork Mt., Humboldt Co., *Chestnut & Drew*; Trinity Summit, *Jepson* 2047; Marble Mt., *Chandler* 1598; Mt. Shasta, *Jepson*.

Ref.—ARCTOSTAPHYLOS NEVADENSIS Gray, Syn. Fl. 2:27 (1878), type loc. Sierra Nevada, 8,000 to 10,000 ft.

11. *A. HOOKERI* Don is a small coast species, that is very weakly represented, occurring from San Francisco Co. to San Luis Obispo Co. It was the first species of this genus to be described from California, at least with California definitely indicated as the place of origin. The type specimens were collected by Lay & Collie at Monterey and are now in the National Herbarium, British Museum. They seem to me representative of the natural type.

Locs.—San Francisco, *Kellogg*; Pajaro Hills, *Chandler* 430; Carmel, *Jepson* 2615, 2616.

Refs.—ARCTOSTAPHYLOS HOOKERI Don, Gen. Syst. 3:386 (1832), type loc. Monterey, *Lay & Collie*. *A. franciscana* Eastw. Bull. Torr. Club, 32:201 (1905), type loc. Laurel Hill, San Francisco, *Eastwood*.

12. *A. UVA-URSI* Spreng. is a boreal species which extends south along the Pacific Coast and occurs in California along the north coast, growing in the sand-dunes of Mendocino and Humboldt Counties.

Locs.—Gaulala, *Brandt*; Fort Bragg, *W. C. Mathews*; Samoa, Humboldt Co., *Davy* 6184.

Refs.—ARCTOSTAPHYLOS UVA-URSI Spreng. Syst. 2:287 (1825). *Arbutus uva-ursi* L. Sp. Pl. 395 (1753), type locs. n. Europe and Canada.

Var. *COACTILIS* Fern. and McBr. Rhod. 16:212 (1914), type loc. Brunswick, Me., *Chamberlain*; this variety is attributed to California but the characters seem too indefinite as applied to our north coast specimens.

13. *A. PUMILA* Nutt. is a local species on the sand-dunes and mesas of Monterey Bay. It has much the habit of *A. nevadensis*, that is, it is low, about 4 to 8 inches high, and forms rough mats a few feet across.

Locs.—Monterey, *Jepson* 5702; Del Monte Heights, *F. G. Woodcock*; Seaside, *F. G. Woodcock*.

Ref.—ARCTOSTAPHYLOS PUMILA Nutt. Trans. Am. Phil. Soc. ser. 2, 8:266 (1843), type loc. Monterey, *Nuttall*.

14. *A. NUMMULARIA* Gray is a dwarf of the flat "pine barrens" of the Mendocino coast, and is associated with dwarf states of *Pinus muricata* and *Cupressus pygmaea*. This species does not, I think, crown-sprout, but after fires seedlings appear abundantly on its area. Mr. Carl Purdy tells me that these seedlings flower the second year.

Locs.—Fort Bragg, *Jepson, W. C. Mathews*; Mendocino City, *Bolander* 4749; Albion, *Davy & Blasdale* 6068.

The plant of Amador Co., described by Parry as *A. myrtifolia*, does not seem specifically distinct and it is here disposed as var. MYRTIFOLIA *Jepson* n. comb.

Locs.—Ione, *K. Brandegee*; betw. Ione and Buena Vista, *Congdon*.

Refs.—ARCTOSTAPHYLOS NUMMULARIA Gray, Proc. Am. Acad. 7:366 (1868), type loc. Mendocino plains, *Bolander*. Var. MYRTIFOLIA *Jepson*. *A. myrtifolia* Parry, Pitt. 1:35:(1887), type loc. ridges e. of Ione, *Parry*.

15. *A. sensitiva* *Jepson* n. sp. is a medium-sized erect shrub 3½ to 5 feet high. It grows on Mt. Tamalpais, and has passed hitherto under the name *A. nummularia*. The true *A. nummularia* Gray of the Mendocino coast is a low or almost mat-like plant. *Arctostaphylos sensitiva* is very shallow-rooted and is one of the most remarkable of all species of the chaparral in its relation to fire. The individuals are completely killed in chaparral fires and do not crown-sprout. In very intense fires the shrub may be completely consumed; in fires of less intensity or governed by suddenly changing air-currents a shrub may be killed by the high temperature generated in its vicinity without any evidence associated with destruction by fire. Such shrubs, retaining all their leaves, but with the foliage brown and dead, stand on the margin of fire-swept bands in the chaparral, as if suddenly electrocuted without any visible sign of injury to the plant as a whole. The shallowness of the root-system increases measurably the chances of its mortality in running fires. It tends to colonize exclusively small areas on Mt. Tamalpais. After fires it reappears promptly on "burns," and fruits at the age of five or six years. It thus adapts itself to short fire-intervals and is a true fire-type shrub.

Locs.—Mt. Tamalpais, *Jepson* (type), *Herbert & Wieslander*; betw. Butano and Little Butano creeks, Santa Cruz Mts., *Dudley*.

Refs.—ARCTOSTAPHYLOS SENSITIVA *Jepson*. *A. nummularia* *Jepson*, Fl. W. Mid. Cal. 370 (1901), not of Gray.

16. *A. CANESCENS* Eastw. This species, here regarded as valid, is reduced in the latest revision of this genus (N. Am. Fl. 29:97,—1914) to *A. tomentosa* Lindl. *A. tomentosa* is a species of the Washington and Oregon coasts which ranges into California along the north coast. *A. canescens* inhabits the summits of the middle Coast

Ranges and never comes down to the immediate vicinity of the coast as does *A. tomentosa*. The latter has characters which distinguish it from *A. canescens* aside from the differences between the two as to reaction to fire.

*A. tomentosa* is a medium-sized dark green shrub; it has a shallow root-system and its large single trunk is not enlarged at the ground. It is killed outright by fire. *A. canescens* is a rather low whitish shrub with numerous small rigid stems which arise from an enlarged woody base or platform just at or below the surface of the ground. It is highly resistant to fire and crown-sprouts vigorously after a chaparral fire. While it has a very large woody base, the stems which arise from this base are never, so far as observed, over 1 or 2 inches in diameter. Further details of differences between these two species are given in the organized diagnoses below.

Locs.—Iaqua Buttes, *Tracy* 4906; near Castle Peak, ne. Mendocino Co., *Jepson*; Red Mt., n. Mendocino Co., *Eastwood*; Blue Lakes grade to Ukiah, *Jepson*; Cobb Mt., *Jepson*; Mt. St. Helena, *Jepson*; Howell Mt., *Jepson*; w. of St. Helena; Hood's Peak Range, *Jepson*; Mt. Tamalpais, *Jepson* 6803; Loma Prieta (acc. *Eastwood*); Santa Lucia Peak, *Jepson* 4744, 4745 (glabrate form); Mt. Wilson, *Peirson* 141.

Ref.—ARCTOSTAPHYLOS CANESCENS *Eastw. Proc. Cal. Acad. ser. 3, 1:84 (1897)*, type loc. Mt. Tamalpais, *Eastwood*.

17. *A. GLANDULOSA* *Eastw.* is another species which has been reduced to *A. tomentosa* *Dougl.* in the latest revision of this genus. (*N. Am. Fl. 29: 97—1914*). It is a low shrub which crown-sprouts under fire, the root-crown expanding horizontally as a result of repeated fires and forming broad woody platforms from which arise the very rigid erect stems. Its reaction to fire is very remarkable. On a Mt. Tamalpais burn my student, Mr. W. C. Mathews, counted 47 sprouts on a root-crown in one square inch. It forms colonies of a kind entirely different from *A. tomentosa* and with an entirely different life-history. It also roots freely from decumbent branches.

Locs.—Red Mt., Mendocino Co., acc. *Eastwood*; Ft. Bragg, *W. C. Mathews*; Mendocino Range near Ukiah, *Jepson* 7640; Twin Sisters Peak, Napa Range, *Jepson* 2391; Mt. Tamalpais, *Jepson* 5719, 5720; Berkeley, *Harriet P. Kelley*; Moraga Ridge, *Jepson* 5717; Oakland Hills, *Jepson* 7440 (berries a little glaucous); Las Trampas Ridge, Contra Costa Co., *Jepson*; Sycamore Cañon (head), Santa Inez Mts., *Jepson*; Echo Mt., San Gabriel Mts., *Peirson* 142.

This species is variable and three varieties are here included under it, namely—Var. *VESTITA* *Jepson* n. comb. (*A. vestita* *Eastw.*), a shrub of the south coast with leaves densely tomentulose beneath: Ben Lomond, *K. Brandegee*; Monterey, *Jepson* 2991, 4004; San Simeon, *K. Brandegee*. Var. *CRASSIFOLIA* *Jepson* n. var. Leaves elliptic, thick, 8 to 12 lines long.—Del Mar, *Jepson* 1606a (type).